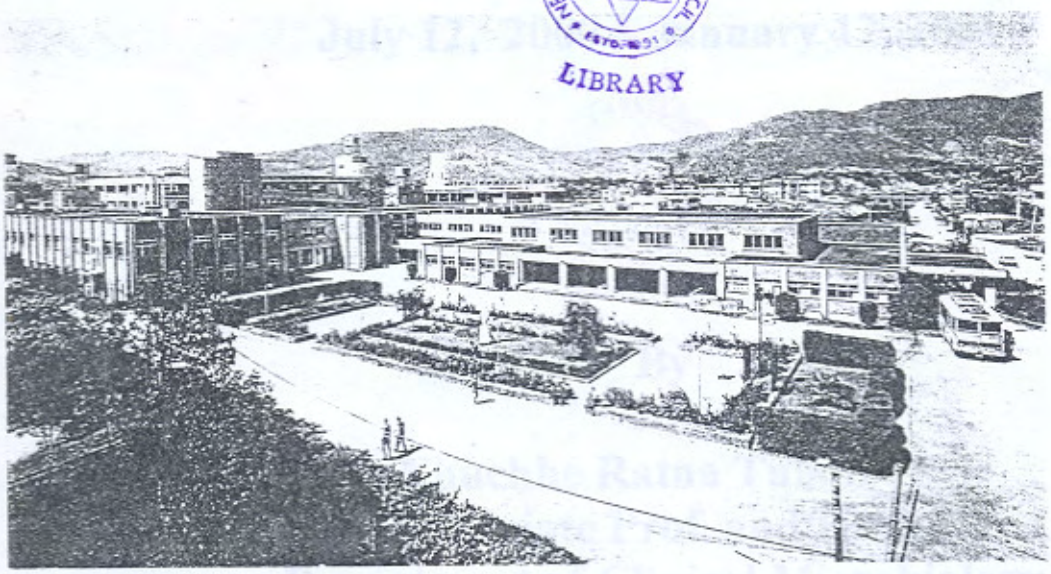
Nepal Health Research Council
Kathmandu Nepal

A Report

Surveillance of Multiple Drug Resistant (MDR) Bacterial Infections Among the patients attending to different Out Patient Department (OPD) And Hospitalized Patients in T.U Teaching Hospital



2001

Submitted by
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Surveillance of Multiple Drug Resistant (MDR) bacterial infections among the patients attending to different Out Patient Departments (OPD) and Hospitalized Patients in TU Teaching Hospital.

A Report of Surveillance Study carried out in
Tribhuvan University Teaching Hospital
Kathmandu, Nepal

July 12, 2000 – January 12, 2001

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Contents **page**

07 **Drug Prescription Pattern in the various departments of T.U.Teaching Hospital**

Surveillance of Multiple Drug Resistant (MDR) bacterial infections among the patients attending to different Out Patient Departments (OPD) and Hospitalized Patients in TU Teaching Hospital.

Objectives

- Study the situation of MDR bacterial infections among the different categories of Out-patients attending to the OPD services.

- Study the situation of MDR bacterial infections among the patients in different wards of the hospital.

- Study the mortality rate among the hospitalised patients.

- Compare the morbidity of Out-patients and the hospitalized patients.

- Identify the bacteria resistant to multiple antimicrobial agents as causes of community acquired and hospital acquired infection.

Abstract

Multiple Drug Resistant (MDR) bacterial isolates have been frequently reported from different parts of the world as an emergence of treatment problem. Such MDR bacterial strains have also been increasingly isolated from the clinical specimens of the hospitalized patients as well as the patients attending to OPD services of TU Teaching Hospital. To know the exact situation of different types of MDR strains this surveillance study was carried out within a defined time frame July 12, 2000 –Jan 12, 2001 in the TU Teaching Hospital. The MDR strain is defined as the strain that showed resistance to three or more antibiotics among the six commonly prescribed drugs. Microbiological methods for the collection, isolation and identification was followed as described in Clinical Microbiology Procedure Handbook, ASM [1].The antimicrobial drug resistance testing of the isolates to the various antibiotic disks were carried out according to standardized disk diffusion method recommended by NCCLS [2] Of the total isolates 634 during six months period from clinical specimens 2505 of the hospitalized patients 271 MDR strains (42.74 %) were found; the most predominants were ***Esch.coli*** 88, ***Pseudomonas aeruginosa*** 62, ***Klebsiella*** sp. 58 and ***Staph. aureus*** 30. Among the patients attending to Out Patients Department (OPD) services, 254 MDR strains (17.82%) were found from 1425 isolates of the total specimens 4450 in the study period; the most predominants were was ***Esch. coli*** 99 followed by ***Klebsiella*** sp. 50, ***Staphylococci aureus*** 44 and ***Pseudomonas aeruginosa*** 38

Introduction

Alexander Fleming first observed the microbial effects of a substance, which later became known as ***Penicillin***; and this was the beginning of antibiotic era. An antibiotic is defined as any chemical substance, produced by microorganisms or semi-synthetic product or synthetic product which has the capacity, in suitable concentration, to inhibit the growth selectively (bacteristatic) or even to destroy the microorganisms (bactericidal) through various mechanisms. After the discovery of ***penicillin*** by Fleming in 1928 a variety of antibiotic drugs came in the market. In the 1940 in New Jersey ***Streptomycin*** was discovered; and aminoglycoside was born. In 1945 an Italian biochemist Giovanni Brotsu isolated the mould cephalosporium which lead for the cephalosporin antimicrobial drug. In 1950 macrolide and glycopeptide antibiotic, ***vancomycin*** was developed. Quinolone drug was synthesized in 1962. Because of the discoveries of new antibiotics the million and million patients suffering from infectious diseases were cured. After the couple of years of ***penicillin*** drug in the markets, the bacterial enzyme penicillinase that breakdown the ***penicillin*** was discovered[3]. This is the start of post antibiotic era. An infection by MDR ***Staplylococci, Enterococci*** among the Gram positive group of bacteria, and Enteric gram negative rods as well as ***Pseudomonas aeruginosa*** [4,32] have been reported after 1940 increasingly and becoming a serious treatment problem throughout the world. As more antibiotics came in the market the rise of antibiotic resistant bacteria also increasingly appeared. An antibiotic resistance is defined as the microbe which is sensitive to certain antibiotic start gaining resistance against it. Resistant strains are now reported against all available classes of antibiotics [5,11] The morbidity and mortality rates because of MDR strains among the very young, elderly population and among immunocompromised patients are very high [6]. The recent increase of MDR strains in hospital has started to pose great difficult in selecting antimicrobial agents for the management of the infection they caused; and obviously the cost in the management of infection caused by MDR strains will be definitely high because of need of acquiring new drug which is of course will be high in cost as well as the cost of prolong staying in the hospital. The some factors responsible for the emergence of resistant strains in hospital include the indiscriminate use of antibiotics, the prolonged hospitalization, the increases in uses of insersion devices etc.

The antimicrobial resistance is a serious emerging problem all over the world particularly in those countries where drugs are freely available without the clinicians' prescription. Infection caused by MDR organisms often lead to death. The increases of resistant bacterial strains are now reported[7,8] from all countries of the globe accusing to the clinicians for the irrational use of drugs and also to the veterinary doctors for their over prescriptions and overuse of antibiotics in the animal feed.

The treatment management of the patients has now become a very big noticeable problem. Helping the clinician for the successful treatment of In-patients as well as Out-patients suffering from the infectious diseases is one of the primary objective of this study; and the clinicians also need to understand that treating one patient without the identity of infecting organisms and its antibiotic susceptibility pattern toward the various antimicrobial drugs may increase the risk of development of resistant strains. To minimize the development of resistant strain the antibiotic should be used to which the infecting organism is most sensitive as reported by diagnostic microbiology laboratory. The present investigation was conducted as a pilot study to find out the incidence of MDR bacterial strains in the TU Teaching Hospital, Kathmandu. Without gathering the information about the existing Multiple Drug Resistant (MDR) Strains we can not reduce the morbidity and mortality due to infections caused by MDR pathogens, reduce the rate of emergence and spread of antimicrobial resistance. And also the infection prevention programme must be launched in simple and effective ways to minimize Hospital Acquired Infections and Community Acquired Infections.

Material and methods

A total of 6955 clinical specimens during six month period beginning from July 12, 2000 to Jan 12, 2001 were investigated to know the pattern of MDR isolates in TU Teaching Hospital, Kathmandu. There were 2505 clinical samples (Urine, Blood, Pus and Sputum) from In-patients of different wards; and 4450 similar specimens from the patients attending to different OPD services. The methods for the collection, isolation and identification was followed as described in Clinical Microbiology Procedure Handlook ASM [1] Gram stain, colonial morphology and biochemical tests were looked-up. The antimicrobial susceptibility testing of the isolates towards the various antimicrobial disks (Oxoid,UK) was done by modified Kirby-Bauer method of disk diffusion technique as recommended by NCCLS M2-A5 1998 [2] using Mueller Hinton agar (Oxoid,UK). The inoculum was prepared by suspending colonies from freshly grown overnight agar plate (non selective medium) in sterile physiological saline; compare the turbidity of the bacterial suspension with that of the Mc Farland standard. Adjusted the turbidity as necessary by dilution or addition of more colonial growth.

Of the following in-vitro testing antibiotic disks ***Ampicillin/Amoxycillin, Amikacin, Cefotaxime, Ceftazidime, Ceftriaxone, Cephalexin, Chloramphenicol, Ciprofloxacin, Cloxacillin, Cotrimoxazole, Erythromycin, Gentamicin, Nalidixic acid, Norfloxacin, Penicillin and Tetracycline*** the selection of basic sets of drug was done for susceptibility testing depending upon the type of bacterial isolates. ***Staphylococci aureus*** ATCC 25923, ***Escherichia coli*** ATCC 25922 and ***Pseudomonas aeruginosa*** ATCC 27853 as standard strains were also tested in parallel with the clinical isolates.

In order to serve better to the clinicians in concern with the antibiotic treatment for the patients of TU Teaching Hospital, it is necessary to know the categories of available drugs as Most Commonly Prescribed, Frequently Prescribed, Occasionally Prescribed and Rarely or Never Prescribed for the patients in TU Teaching Hospital; and therefore a questionnaire form was developed and given to hospital doctors requesting to give the tick-mark to the right answer. The doctors include the Post-graduate medical students of different faculty : Internal Medicine, Gynaecology&Obstetric, Orthopaedic, General Surgery, ENT, Paediatrics and Neonate, Dermatology and Psychiatry.

Result:

Of the total 2505 samples received from hospitalized patients of different wards there were 1479(59.04%) urine, 481(19.20%) pus, 274(10.93%) blood and 271(10.81%) sputum

Table I.

Hospitalized Patients
Clinical specimens – MDR Bacterial Isolates
2505 in six months period

Specimen	Nos	Isolates	MDR Strains
Urine	1479	230	81
Pus	481	215	91
Blood	274	60	36
Sputum	271	129	63

Out of 1479 urine specimens there were 230 culture positive of which MDR bacterial strains were detected in 81(35.21%) cases in which the most predominants were ***Esch coli*** 51(22.17%) ***Klebsiella sp.*** 14(6.08%) and ***Staphylococcus aureus*** 5(2.17%)

Table II.

Urine specimens – Hospitalized patients
Pattern of MDR Bacterial Isolates
(81 MDR strains in 230 Isolates)

Bacteria	No. of Isolates	No. of MDR strains
Escherichiae coli	166	51 (22.17%)
Klebsiella sp.	24	14 (06.08%)
Staph. aureus	22	05 (02.17%)
Acinetobacter sp.	04	04
Strepto.faecalis	09	03
Pseudomonas aeruginosa	03	03
Enterobacter sp	01	-
Staph. albus	01	-
	230	81

Of the 481 pus specimens the culture positives were found in 215(44.69%) cases of which MDR bacterial strains were detected in 91(42.32%) cases in which the most predominants were ***Klebsiella sp***. 24(11.16%), ***Pseudomonas aeruginosa*** 22 (10.23%) and ***Esch.coli*** 21(9.76%).

Table III

Pus specimens – Hospitalized patients
Pattern of MDR Bacterial isolates
91 MDR Strains in 215 isolates

Bacteria	No. of isolates	No. of MDR Strains
Klebsiella sp.	32	24 (11.16%)
Pseudomonas aeruginosa	27	22 (10.23%)
Escherichiae coli	52	21 (09.76%)
Staph.aureus	69	08
Acinetobacter sp.	07	07
Proteus sp.	10	06
Strepto. faecalis	06	02
Enterobacter sp.	02	01
Beta Streptococcus	05	-
Staph. albus	04	-
Strepto.pneumoniae	01	-
	215	91

Out of 274 blood, there were 60 culture positive in which MDR bacterial strains were detected in 36 (60%) of which ***Staph. aureus*** 13(21.66%), ***Esch.coli*** 8(13.33%) and ***Klebsiella*** sp. 7(11.66%) were the predominants

Table IV.

Blood specimens – Hospitalized patients
Pattern of MDR Strains
36 MDR Strains in 60 Isolates

Bacteria	No. of Isolates	No.of MDR Strains
Staph. aureus	21	13 (21.66%)
Esch. coli	09	08 (13.33%)
Klebsiella sp.	09	07 (11.66%)
Pseudomonas aeruginosa	04	03
Acinetobacter sp	02	02
Salmonella typhi	09	01
Enterobacter sp.	02	01
Citrobacter sp.	01	01
Staph. albus	02	-
Strepto.faecalis	01	-
	60	36

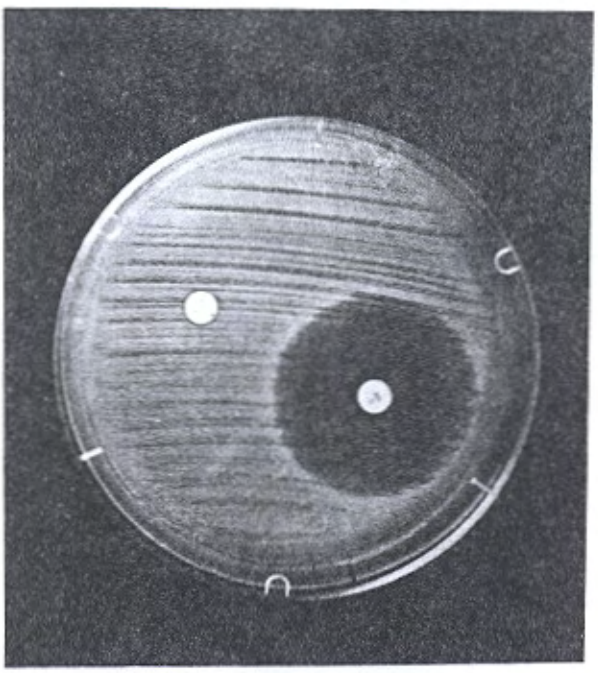
Of the 271 sputum specimens the culture positive(significant isolates) were found in 129 cases of which MDR bacterial strains were 63 (48.83%) in which ***Pseudomonas aeruginosa*** 34 (26.3%), ***Klebsiella sp***. 13 (10.07%) and ***Esch. coli*** 8 (6.20%) were the predominants

Table V

Sputum specimens – Hospitalized patients
Patterns of MDR Bacterial Isolates
63 MDR Strains in 129 Isolates

Bacteria	No. of Isolates	No.of MDR Strains
Pseudomonas aeruginosa	40	34 (26.30%)
Klebsiella sp.	27	13 (10.07%)
Esch.coli	14	08 (06.20%)
Staph. aureus	10	04
Acinetobacter sp	02	02
Citrobacter sp.	01	01
Haemophilus influenzae	15	01
Strepto. pneumoniae	20	-
	129	63

The drug resistant problem exists in high degree in hospital; the multidrug resistant strains among the isolates are predominantly ***Esch coli*** and other Gram negative rods such as ***Klebsiella sp., Pseudomonas aeruginosa, Acinetobacter, Enterobacter sp.*** etc. Gram positive cocci are still a problem; all the ***Staph. aureus***, MDR Strains, are the oxacillin resistant.



. Control plates showing the susceptibility

Ward-wise study of MDR Bacterial Isolates

All the isolates from the different clinical specimens of hospitalised patients were also studied in ward-wise

Table VI

Ward wise distribution
MDR Bacterial Isolates from Urine specimens

Name of Ward	No. of isolates
Female Surgical	22
ICU	14
Male Surgical	13
Anex II(Medical)	09
Maternity	06
Male medical	06
Anex I(Surgery)	05
Female Medical	02
Neuro.	02
Orthopaedic	01
Ear Nose Throat	01

Table VII

Ward wise distribution
MDR Bacterial Isolates from Pus Specimens

Name of ward	No of Isolates
Male Surgical	21
Female Surgical	18
Anex I (Surgery)	18
ICU	10
Maternity	10
Ear Nose Throat	05
Burn	04
Post Operative	02
Orthopaedic	01
Neuro	01
Male Medical	01

Table VIII

Ward wise distribution
MDR Bacterial Isolates from Blood Specimens

Name of Ward	No of Isolates
Neonate	20
ICU	07
Maternity	03
Male Medical	02
Anex II (Medical)	01
Anex I (Surgical)	01
Male Surgery	01
Female Surgery	01

Table IX

Ward wise Distribution
MDR Bacterial Isolates from Sputum Specimen

Name of ward	No of Isolates
ICU	31
Anex II (Medical)	14
Male Medical	12
SICU	02
Female Surgery	01
Anex I (Surgery)	01

The tables VI to IX showed Multidrug Resistant Bacteria were found in all the wards; more MDR strains were isolated from ICU, Neonate, Male Surgery, Female Surgery and Male Medical (Anex II) ward.

The tables also showed that MDR bacterial isolates were different depending on the clinical cases of patients; also the pattern of MDR isolates from the clinical specimens of different wards were found different such as Neonate wards, ICU in blood specimens; Female Surgical ward, ICU in urine specimens; Male Surgical ward, Female Surgical ward in pus specimens; ICU and Anex II (Medical) in sputum specimens.

Of the total 4450 sample received from patients attending to different OPD services of TU Teaching Hospital there were 1947 (43.75%) Urine, 1229 (27.61%) blood, 673 (15.12%) pus and 601(13.50%) sputum specimen

Table X

Patients attending Out patients Services of TU Teaching Hospital
Clinical specimens – MDR Bacterial Isolates
4450 in 6 months periods

Specimens	No	Isolates	MDR Strains
Urine	1947	517	122
Blood	1229	131	031
Pus	0673	468	061
Sputum	0601	297	040
	4450	1413	254

In 1947 urine specimens culture positives were found in 517(26.55%) of which MDR bacterial strains were detected in 122(23.59%) cases in which ***Esch.coli*** 72(13.12%), ***Klebsiella sp***.20(3.86%) and ***Staph. aureus*** 13(2.51%) were the predominants

Table XI.

Urine specimens – OPD patients
Pattern of MDR Bacterial Isolates
122 MDR Strains in 517 Isolates

Bacteria	No. of Isolates	No. of MDR Strains
Esch. coli	353	72 (13.12%)
Klebsiella sp	065	20 (03.86%)
Staph. aureus	053	13 (02.51%)
Pseudomonas aeruginosa	016	09
Strepto. faecalis	008	03
Proteus sp.	009	02
Acinetobacter sp.	002	02
Staph. albus	011	01
	517	122

Out of 1229 blood, there were 131 culture positive of which MDR bacterial strains were detected in 31(23.66%) cases in which ***Esch. coli*** 11(8.39%), ***Staph. aureus*** 11(8.39%) and ***Klebsiella*** 4 (3.05%) were the predominants

Table XII

Blood specimens – OPD Patients
Pattern of MDR Bacterial Isolates
31 MDR Strains in 131 Isolates

Bacteria	No. of Isolates	No of MDR Strains
Staph. aureus	37	11 (8.39%)
Esch. coli	15	11 (8.39%)
Klebsiella sp.	04	04 (3.05%)
Proteus sp.	08	02
Acinetobacter sp.	03	03
Salmonella typhi	53	-
Staph. albus	09	-
Pseudomonas aeruginosa	02	-
	131	31

In 673 Pus specimens the culture positives were found in 466 of which MDR bacterial strains were detected in 61 (12.70%) cases in which ***Staph.aureus*** 20(4.16%), ***Klebsiella*** 14(2.91%), ***Pseudomonas aeruginosa*** 11(2.29%) were the predominants

Table XIII

Pus specimens – OPD patients
Pattern of MDR Bacterial Isolates
61 MDR Strains in 468 Isolates

Bacteria	No. of Isolates	No. of MDR Strains
Staph. aureus	321	20 (4.27%)
Klebsiella sp.	045	14 (2.99%)
Pseudomonas aeruginosa	022	11 (2.35%)
Esch. coli	023	08
Proteus sp.	014	03
Enterobacter sp.	002	02
Strepto. faecalis	010	01
Acinetobacter sp.	002	01
Citrobacter sp.	005	01
Beta Streptococcus	022	-
Strepto.pneumoniae	002	-
	468	61

In 601 sputum samples the culture positives(significant isolates) were found in 297 cases of which MDR bacterial strain were detected in 40(13.46%) cases in which ***Pseudomonas aeruginosa*** 18 (6.06%) ***Klebsiella sp.*** 12 (4.04%) and ***Esch. coli*** 8 (2.69%) were the predominants

Table XIV

Sputum specimens – OPD Patients
Pattern of MDR Bacterial Isolates
40 MDR Strains in 297 Isolates

Bacteria	No. of Isolates	No. of MDR Strains
Pseudomonas aeruginosa	33	18 (6.06%)
Klebsiella sp.	51	12 (4.04%)
Esch. coli	23	08 (2.69%)
Strepto.pneumoniae	46	01
Citrobacter sp.	01	01
Haemophilus influenzae	128	-
Beta Streptococcus	15	-
	297	40

All the above tables showed that the problem of MDR bacteria exist in home and hospital. Patients leave hospital early to treat at home; and resistant organisms have been tracked from the patients.

Table XV

Percentage Distribution Pattern of MDR Isolates
From Various Clinical Samples of Hospitalized Patients

MDR Strain (Total Isolates)

Bacterial Isolates	*Blood*	*Urine*	*Pus*	*Sputum*	*Total*	*% 634*
Escherichia coli	8(09)	51(166)	21(52)	8(14)	88(241)	13.88
Pseudomonas aeruginosa	3(04)	3(003)	22(27)	34(40)	62(074)	9.77
Klebsiella species	7(09)	14(024)	24(32)	13(27)	58(092)	9.14
Staphylococcus aureus	13(21)	5(022)	8(69)	4(10)	30(122)	4.73
Acinetobacter species	2(02)	4(004)	7(07)	2(02)	15(015)	2.36
Proteus species			6(10)		6(010)	0.94
Streptococcus faecalis	0(01)	3(009)		2(06)	5(016)	0.78
Enterobacter species	1(02)	1(001)		1(02)	3(005)	
Citrobacter species	1(01)			1(01)	2(002)	
Salmonella typhi	*1*(09)				1(009)	
Haemophilus influenzae				1(15)	1(015)	
Streptopneumoniae			0(01)	0(20)	0(021)	
Staphylococcus albus	0(02)	0(001)		0(04)	0(007)	
Beta Streptococcus			0(05)		0(005)	
	36(60)	81(230)	91(215)	63(99)	271(634)	

Esch. coli, Pseudomonas aeruginossa, Klebsiella sp. Staph. Aureus and Acinetobacter sp. were isolated from all the four samples except ***Staph. aureus*** from the sputum specimen from the clinical specimens of the hospitalized patients. These four are the most common specimens among the various clinical specimens. ***Esch coli*** was found the most common MDR isolates.

Table XVI

Percentage Distribution Pattern of MDR Isolates From Various Clinical Samples of Patients Attending to OPD Services MDR Strain(Total Isolates)

Bacterial Isolates	Blood	Urine	Pus	Sputum	Total	% 1413
Escherichia coli	11(15)	72(353)	8(023)	8(023)	99(414)	6.94
Klebsiella species	04(04)	20(065)	14(045)	12(051)	50(165)	3.50
Staphylococcus aureus	11(37)	13(053)	20(321)	-	44(411)	3.08
Pseudomonas aeruginosa	0(02)	09(016)	11(022)	18(033)	38(073)	2.66
Proteus species	02(08)	02(009)	03(014)	-	07(031)	
Acinetobactor species	03(03)	02(002)	01(002)	-	06(007)	
Strepto. faecalis	-	03(008)	01(010)	-	04(018)	
Enterobacter species	-	-	02(002)	-	02(002)	
Citrobactor species	-	-	01(005)	01(001)	02(006)	
Staphylococcus albus	0(09)	01(011)	-	-	01(020)	
Streptopneumoniae	-	-	0(002)	01(046)	01(048)	
Salmonella typhi	0(53)	-	-	-	0(053)	
Haemophilus influenzae	-	-	-	0(128)	0(128)	
Beta Streptococcus	-	-	0(022)	0(015)	0(037)	
	31(131)	122(517)	61(459)	40(297)	254(1413)	

Esch. coli, Pseudomonas aeruginossa, Klebsiella sp. Staph. aureus and Acinetobacter sp. were isolated from all the four samples, the clinical specimens of the hospitalized patients of which Table XV showed ***Esch. Coli, Pseudomonas aeeruginosa and Klebsiella sp***. were predominant. These three predominants MDR bacterial isolates were also noticed from all the four clinical specimens of the Out-patients of the TU Teaching Hospital.

The questionnaire forms collected from the hospital doctors of different departments showed the different drug prescription patterns in the different departments (Table XVII to Table XXIV)

यस त्रि.वि. शिक्षण अस्पतालको विरामीहरुको औषधि उपचार सम्बन्धी यस IOM, Maharajgunj Campus and T.U. Teaching Hospital, Microbiology Dept. को Diagnostic Bacteriology Laboratory बाट antibiotic susceptibility testing गरी सहयोग पुर्‍याई राखेको सबैलाई विदितै छ । यस सम्बन्धी निम्न लिखित antibiotics for invitro tests को लागि उपलब्ध भएको कारण यस अस्पतालका विरामीहरुमा प्रयोग हुने antibiotics तल उल्लेखित अनुसार Tick mark ( ) लगाई सहयोग गरिदिनु हुन अनुरोध गर्दछु ।

Antibiotics/ Chemotherapeutic	Most commonly prescribed	Frequently prescribed	Occasionally prescribed	Never/rarely prescribed
Amikacin				
Ampicillin/Ammoxycillin				
Carbenicillin				
Cefacior				
Cefotaxime				
Ceftazidime				
Ceftriaxone				
Cephalexin				
Chloramphenicol				
Ciprofloxacin				
Clindamycin				
Cloxacillin				
colistin				
Co-trimoxazole				
Erythromycin				
Gentamicin				
Nalidixic Acide				
Norfloxacin				
Ofloxacin				
Penicillin - G				
Polymyxin - B				
Tetracycline				
Tobramycin				
Vancomycin				

Remark : The other drug introducing to hospital if any
e.g. Amoxicillin - clavulanic acid
Ampicillin =- Sulbactam

Name Dr. _____
Department : _____
Date : _____

Table XVII

Drug Prescription Pattern
Department of Internal Medicine
Submitted questionnaire forms filled up by 20 doctors

Antibiotic / Chemotherapeutic	Most commonly Prescribed	Frequently Prescribed	Occasionally Prescribed	Never/rarely Prescribed
Amikacin	03	07	10	-
Ampicillin/Amoxycillin	16	04	-	-
Carbenicillin	-	03	03	14
Cefaclor	02	11	06	01
Cefotaxime	04	14	02	-
Ceftazidime	02	06	12	-
Ceftriazone	06	12	02	-
Cephalexin	06	10	04	-
Chloramphenicol	02	04	14	-
Ciprofloxacin	18	02	-	-
Clindamycin	01	-	14	05
Cloxacillin	14	05	01	-
Colistin	-	-	03	17
Co-trimoxazole	05	06	09	-
Erythromycin	09	09	02	-
Gentamicin	11	08	01	-
Nalidixic acid	01	06	11	02
Norfloxacin	10	04	06	-
Ofloxacin	02	08	10	-
Penicillin G	13	05	02	-
Polymyxin B	-	-	08	12
Tetracycline	04	05	09	02
Tobramycin	01	02	13	04
Vancomycin	-	-	19	01

The table showed that ***Ciprofloxacin, Ampicillin, Cloxacillin,Penicillin*** and ***Gentamicin*** were the first five most commonly prescribed drugs of which the first four were the oral drug. ***Cefotaxime, Ceftriaxone, Cefaclor, Cephalexin, Erythromycin***. were frequently prescribed drugs. ***Vancomycin, Tobramycin Clindamycin,Carbenicillin, Ceftazdime, Nalidixic acid, Amikacin*** were the occasionally prescribed. ***Colistin and Polymyxin B*** were rarely used drugs.

Table XVIII

Drug Prescription Pattern
Department of Gynaecology & Obstetric
Submitted Questionnaire forms - 12

Antibiotic / Chemotherapeutic	Most commonly Prescribed	Frequently Prescribed	Occasionally Prescribed	Never/rarely Prescribed
Amikacin	-	02	10	-
Ampicillin/Amoxycillin	05	05	02	-
Carbenicillin	-	-	03	09
Cefaclor	01	04	05	02
Cefotaxime	03	07	02	-
Ceftazidime	01	04	04	03
Ceftriazone	02	03	06	01
Cephalexin	07	05	-	-
Chloramphenicol	-	-	06	03
Ciprofloxacin	11	01	-	-
Clindamycin	01	04	04	03
Cloxacillin	04	04	03	01
Colistin	-	-	02	10
Co-trimoxazole	02	03	06	01
Erythromycin	02	03	06	01
Gentamicin	05	05	02	-
Nalidixic acid	04	05	03	-
Norfloxacin	05	05	02	-
Ofloxacin	03	02	05	02
Penicillin G	01	01	05	05
Polymyxin B	-	-	02	10
Tetracycline	-	02	06	04
Tobramycin	01	01	02	08
Vancomycin	-	-	06	06

The table showed that **Ciprofloxacin, Cephalexin** were the most commonly used drug where as ***Cefotaxime*** was the frequently prescribed drug followed by ***Gentamicin, Norfloxacin, Nalidixic acid, Ampicillin/Amoxycillin. Amikacin, Chloramphenicol, Cotrimoxazole, Erythromycin, Vancomycin*** were the occasionally prescribed drugs. ***Carbenicillin, Colistin, Polymyxin, Tobramycin*** were rarely used drugs.

Table XIX
Drug Prescription Pattern
Department of General Surgery
Submitted Questionnaire forms-11

Antibiotic / Chemotherapeutic	Most commonly Prescribed	Frequently Prescribed	Occasionally Prescribed	Never/rarely Prescribed
Amikacin	03	03	05	-
Ampicillin/Amoxycillin	06	02	03	-
Carbenicillin	-	-	03	08
Cefaclor	-	05	06	-
Cefotaxime	01	08	02	-
Ceftazidime	-	02	09	-
Ceftriazone	03	07	01	-
Cephalexin	05	05	01	-
Chloramphenicol	-	02	08	01
Ciprofloxacin	09	02	-	-
Clindamycin	01	-	08	02
Cloxacillin	09	02	-	-
Colistin	-	-	04	07
Co-trimoxazole	03	02	06	-
Erythromycin	02	03	06	-
Gentamicin	04	05	02	-
Nalidixic acid	-	03	08	-
Norfloxacin	08	03	-	-
Ofloxacin	01	07	03	-
Penicillin G	01	08	02	-
Polymyxin B	-	-	05	06
Tetracycline	-	04	06	01
Tobramycin	01	03	05	02
Vancomycin	-	02	07	02

Eleven questionnaire forms submitted from the doctors of Surgery department showed ***Ciprofloxacin, Cloxacillin, Norfloxin, Ampicillin/ammoxycillin*** were the most commonly prescribed drugs. ***Cefotaxime, Penicillin, O floxacin, Ceftriaxone*** were the frequently prescribed drugs. ***Ceftazidime, Clindamycin, Chloramphenicol, Vancomycin, Cefaclor, Cotrimmoxazole, Tetracycline*** were occasionally prescribed drug. ***Carbenicillin, Colistin and Polymyxin B*** were the rarely prescribed drugs.

Table XX

Drug Prescription Pattern
Department of Paediatric and Neonate
Submitted Questionnaire forms - 5

Antibiotic / Chemotherapeutic	Most commonly Prescribed	Frequently Prescribed	Occasionally Prescribed	Never/rarely Prescribed
Amikacin	03	01	01	-
Ampicillin/Amoxycillin	02	01	02	-
Carbenicillin	-	-	01	04
Cefaclor	-	-	04	01
Cefotaxime	03	02	-	-
Ceftazidime	-	-	04	01
Ceftriazone	02	02	01	-
Cephalexin	01	04	-	-
Chloramphenicol	02	01	02	-
Ciprofloxacin	01	02	02	-
Clindamycin	01	-	03	01
Cloxacillin	03	02	-	-
Colistin	-	-	-	05
Co-trimoxazole	01	02	01	01
Erythromycin	01	04	-	-
Gentamicin	03	02	-	-
Nalidixic acid	01	02	02	-
Norfloxacin	02	02	01	-
Ofloxacin	-	01	04	-
Penicillin G	03	02	-	-
Polymyxin B	-	-	02	03
Tetracycline	-	-	04	01
Tobramycin	-	-	03	02
Vancomycin	01	02	02	-

The table showed ***Amikacin, Cefotaxime, Cloxacillin, Gentamicin, Penicillin G*** were the most Commonly prescribed drugs. ***Cephalexllin, Erythromycin*** were the frequently prescribed drugs. ***Cefaclor, Ceftazidime, O floxacin, Clindamycin, Tobramycin*** were occasionally prescribed drugs. ***Colistin, Carbenicillin and Polymyxin B*** were rarely prescribed drugs.

Table XXI
Drug Prescription Pattern
Department of ENT
Submitted Questionnaire forms – 5

Antibiotic / Chemotherapeutic	Most commonly Prescribed	Frequently Prescribed	Occasionally Prescribed	Never/rarely Prescribed
Amikacin	-	-	05	-
Ampicillin/Amoxycillin	04	01	-	-
Carbenicillin	-	-	02	03
Cefaclor	-	01	04	-
Cefotaxime	-	02	03	-
Ceftazidime	-	01	04	-
Ceftriazone	-	02	03	-
Cephalexin	-	03	02	-
Chloramphenicol	01	02	02	-
Ciprofloxacin	04	-	01	-
Clindamycin	-	01	02	02
Cloxacillin	02	01	02	-
Colistin	-	-	01	04
Co-trimoxazole	01	01	03	-
Erythromycin	-	02	03	-
Gentamicin	03	02	-	-
Nalidixic acid	-	01	02	02
Norfloxacin	-	02	01	02
Ofloxacin	01	01	03	-
Penicillin G	02	-	02	01
Polymyxin B	-	01	01	03
Tetracycline	01	02	01	01
Tobramycin	-	-	03	02
Vancomycin	-	-	03	02

Ciprofloxacin, Ampicillin/Ammoxycillin, Gentamycin were the most commonly prescribed drugs, where as ***Cephalexin*** was the frequently prescribed drug. ***Amikacin, Ceftazidime,Cefotaxime, Ceftriaxone, Cotrimoxazole, Erythromycin, O floxacin, Tobramycin, Vancomycin*** were the occasionally prescribed drug. **Colistin, Carbenicillin, Polymyxin B** were the rarely used.

Table XXII
Drug Prescription Pattern
Department of Dermatology and STDs
Submitted Questionnaire forms – 3

Antibiotic / Chemotherapeutic	Most commonly Prescribed	Frequently Prescribed	Occasionally Prescribed	Never/rarely Prescribed
Amikacin	-	-	-	03
Ampicillin/Amoxycillin	-	-	02	01
Carbenicillin	-	-	-	03
Cefaclor	02	01	-	-
Cefotaxime	-	-	02	01
Ceftazidime	-	-	03	-
Ceftriazone	-	02	01	-
Cephalexin	02	-	01	-
Chloramphenicol	-	-	-	03
Ciprofloxacin	01	02	-	-
Clindamycin	-	01	01	01
Cloxacillin	03	-	-	-
Colistin	-	-	-	03
Co-trimoxazole	02	-	01	-
Erythromycin	02	01	-	-
Gentamicin	-	-	01	02
Nalidixic acid	-	-	-	03
Norfloxacin	-	-	-	03
Ofloxacin	-	01	02	-
Penicillin G	-	-	02	01
Polymyxin B	-	-	-	03
Tetracycline	01	02	-	-
Tobramycin	-	-	-	03
Vancomycin	-	-	-	03

Three questionnaire forms showed ***Cloxacillin*** was the commonly prescribed drug followed by ***Cephalexin, Erythromycin, Cotrimoxazole, Cefaclor, Ceftriaxone, Ciprofloxacin, Tetracycline*** were frequently prescribed. ***Ceftazidime, O floxacin, Ampicillin/Ammoxycillin*** were the occasionally prescribed drugs. ***Amikacin, Carbenicillin, Chloramphenicol, Colistin, Gentamicin, Nalidixic acid, Norfloxacin, Polymyxin B, Tobramycin, Vancomycin*** were rarely prescribed.

Table XXIII
Drug Prescription Pattern
Department of Orthopaedic
Submitted Questionnaire - 3

Antibiotic/ Chemotherapeutic	Most commonly Prescribed	Frequently Prescribed	Occasionally Prescribed	Never/rarely Prescribed
Amikacin	-	01	02	-
Ampicillin/Amoxycillin	-	02	01	-
Carbenicillin	-	01	02	-
Cefaclor	01	-	02	-
Cefotaxime	01	-	01	01
Ceftazidime	01	-	01	01
Ceftriazone	01	-	02	-
Cephalexin	01	02	-	-
Chloramphenicol	-	-	01	02
Ciprofloxacin	03	-	-	-
Clindamycin	-	-	02	01
Cloxacillin	02	01	-	-
Colistin	-	-	-	03
Co-trimoxazole	-	01	02	-
Erythromycin	-	01	02	-
Gentamicin	-	02	01	-
Nalidixic acid	-	01	01	-
Norfloxacin	-	01	01	01
Ofloxacin	-	01	-	02
Penicillin G	-	-	-	03
Polymyxin B	-	-	-	03
Tetracycline	-	-	02	01
Tobramycin	-	01	02	-
Vancomycin	-	01	01	01

The questionnaire forms showed that antibiotics were not normally prescribed. Of the Antibiotics ***Ciprofloxacin, Cloxacillin*** were the commonly prescribed drug. **Gentamicin,Cephalexin and Ampicillin/Ammoxycillin** were the frequently prescribed drugs. ***Amikacin,Cefaclor, Ceftriaxone, Clindamycin, Cotrimoxazole, Erythromycin, Tetracycline, Tobramycin*** were occasionally prescribed drugs. ***Colistin, Penicillin, Polymyxin B, Chlomphenicol*** were rarely prescribed drugs

Table XXIV

Drug Prescription Pattern
Department of Psychiatric
Submitted Questionnaire forms - 2

Antibiotic/ Chemotherapeutic	Most commonly Prescribed	Frequently Prescribed	Occasionally Prescribed	Never/rarely Prescribed
Amikacin	-	-	02	
Ampicillin/Amoxycillin	-	01	-	01
Carbenicillin	-	-	-	02
Cefaclor	-	-	-	02
Cefotaxime	-	-	01	01
Ceftazidime	-	-	01	01
Ceftriazone	-	-	02	-
Cephalexin	-	01	-	01
Chloramphenicol	-	-	01	01
Ciprofloxacin	01	01	-	-
Clindamycin	-	-	01	01
Cloxacillin	01		01	
Colistin	-	-	-	02
Co-trimoxazole	-	-	01	01
Erythromycin	-	-	01	01
Gentamicin	-	-	01	01
Nalidixic acid	-	-	01	01
Norfloxacin	-	-	02	-
Ofloxacin	-	-	01	01
Penicillin G	-	-	01	01
Polymyxin B	-	-	-	02
Tetracycline	-	-	01	01
Tobramycin	-	-	-	02
Vancomycin	-	-	-	02

Of the different faculties, this department was found the least antibiotic prescribing for the patients.

The above tables showed that ***Ciprofloxacin*** was extensively prescribed antibiotic by all categories of doctors working in different departments. Of the antibiotics listed in the questionnaire form except ***Gentamicin*** the other most commonly and frequently prescribed drugs are the oral drugs and these include extended group of ***Penicillin, Cephalexin, Cefotaxime, Erythromycin, Norfloxacin, Nalidixic acid.*** The antibiotics ***Amikacin, Clindamycin, Chlomphenical, O floxacillin, Ceftriaxone, Cotrimoxazole, Cefaclor, Ceftazidime, Tetracycline, Tobramycin*** and ***Vacncomycin*** were noticed occasionally prescribed; and many of these are non-oral drugs. Only three antibiotics ***Carbenicillin, Colistin and Polymyxin B*** are rarely prescribed.

Discussion

Within a few years after the discovery of Penicillin by Fleming in 1928, a penicillinase producing ***Staphylococci*** appeared and became world wide epidemic. Initially the problem of Resistant Strains was managed by the newly introduced antimicrobial drug. After some years, the resistant strains began to appear; today we see the emergence of resistant pathogens among previously susceptible species. We need to know where and how they have developed resistance so quickly. Genetic studies show that they have acquired from existing resistant strains. Overuse and misuse of antibiotics by the clinician was blamed for the emergence of resistant strains. Now MDR Strains have been reported from all parts of the world; and the infections caused by MDR strains particularly in the hospital are becoming day to day problems for the clinician in the management of treatment. This study showed there were more MDR strains from clinical specimens of hospitalized patients compared with out-patients. The MDR strains were noticed more in those drugs which are available in capsule/tablet form. Some hospital strains, the invasive gram-negative enteric bacteria mostly ***Klebsiella sp.*** are not susceptible to any available drug. Although the problem of bacterial resistance to antimicrobial drugs was solved by the discovery of new classes of drugs such as the aminoglycoside, macrolide, glycopeptide there is no assurance that the development of new antibiotic / antimicrobial drug can keep pace with the ability of bacteria pathogen to develop resistance. This problem is noticed more in the developing countries where there no rational use of drug. This basic problem is more worsened by the self drug taking practices of patients, availability of drugs without the prescription for purchase in local pharmacist or open-air market. The of MDR is in fact a more economic problem because of high cost of treatment and there is also a problem of not immediate availability of safe and effective drug. So the emergence of MDR is a serious growing problem.

Methicillin resistant Staphylococci, MDR ***Pseudomonas aeruginosa*** and bacteria of Enterobacteriaceae family as are the main problem found in this study from In-patients as well as Out-patients attending to Out Patients Services of TU Teaching Hospital. The drug resistant problem exists more in hospital, we have mounting with multidrug resistant ***Esch coli*** and other Gram negative rods such as ***Klebsiella, Pseudomonas aeruginosa, Acinetobacter, Enterobacter*** etc. Gram positive cocci are still a problem; all the ***Staph. aureus***, MDR strains, were the ***oxacillin*** resistant. These findings showed the similarity with the findings of the other countries as reported by WHO[12], APUA[36,37] and other reports [14,30,31,33.34,35,38,39,40] The findings of TU Teaching Hospital showed many of ***ampicillin*** resistant strains were usually resistant to the antimicrobial drugs including ***erythromycin, tetracycline, chloramphenicol and trimethoprim***

sulfamethoxazole.The study showed that MDR bacterial isolates were found in all wards. Depending on the clinical cases of patients, pattern of MDR isolates from clinical specimens in different wards were different such as Neonate ward, ICU ward in blood specimens; female surgical ward in pus specimens; ICU and Anex II (Medical) in sputum specimens. There are frequent reports [9,10,29] of treatment problem caused by the emergence of extended spectrum beta lactamase in bacteria; and these bacteria are usually resistant to other antimicrobial drugs of common uses. Also the world wide dissemination of ***penicillin*** resistant ***pneumococci*** (often multidrug resistant) had been reported [26,27,28] Perhaps these strains arose in response to the selective pressure created by the use of broad spectrum antibiotics including the extended spectrum antibiotic Cephalosporin. The colonisation and infection with bacteria have also been associated with lengthy hospital stays[13,22-25,41] such as in an intensive care or oncology unit and in case of catheterization of the urinary bladder. One important step in preventing, minimizing to the increase in antimicrobial resistance is to wash the hands in between the patients check up with use of hand washing solution. The doctors, nurses and other supporting staffs must support sincerely to Infection Prevention Policies of the hospital. The strain producing extended spectrum beta lactamases have caused hospital outbreaks involving the infection of large number of patients.

Although many surgeons understand very well about the infection prevention practices but there are still Post Operative infections. The resistant pathogens present in environment are responsible for a Post Operative wound infection and the break in aseptic technique is responsible for this. The surgical patients as the risk factors in most post operative infection include age for example elderly patients and underlying diseases such as diabetic, kidney, hepatic disease or lung infection. The transmission between patients must be stopped through the use of improved aseptic technique. The spread from bacterial colonization to infection must be halted by improved sanitation and strengthening hospital infection control programme. Adherance to infection control guidelines is important both in the operating room and in the post operation recovery room.

A good Physician or medical practitioner, when available, needs to see as many patients as possible in the short time period and may require to prescribe the drug without any laboratory support. They often feel compelled to prescribe antimicrobial drugs to meet patient expectation. This is usual situation even these days; and this is not considered as rational use of antibiotic. So it is now required to educate the physicians and the general public about the appropriate use of drugs; and beside this there is also a need to improve the availability of effective drugs and to monitor the emergence of resistant strains. It has been regularly reported that the misuse and overuse of antibiotics and their effectiveness against the bacterial pathogens has been increasingly ineffective to kill the bacteria. Therefore the prudent use of antibiotics is very necessary; this will not only curtail health care costs and the potential side effects by

taking the drugs, but also diminish the wide ecology effects leading to selection of antibiotic resistant forms of common diseases. There were reports[15,16] that many of the resistant strains can be transferred from one kind of resistant bacteria to other bacteria; and this can be minimized by appropriate use of antimicrobial drug. Fortunately, older antibiotics are still powerful enough for the treatment of the vast majority of bacterial infectious diseases. This situation, however is not secure and is changing continually. In many parts of the world, inexpensive, safe antibiotics are no longer useful due to bacterial resistance. Newer drugs may be required; and newly introduced drug may not be affordable for the people of the countries like Nepal.

TU Teaching Hospital is now facing the severe problem of MDR bacterial infections. In order to serve better to the Clinician in concern with the antibiotic treatment for the patients of TU Teaching Hospital, a questionnaire form was developed as a part of study and given to hospital doctors requesting to give the tick-mark for the right answer. The questionnaire forms, collected back, showed the drug of choice were different in different categories of patients under different Departments such as Internal Medicine, Gynecology & Obstetric, General Surgery, ENT, Orthopedic and Psychiatry; however the quinolone drug ***Ciprofloxacin*** was found most commonly prescribed drug in all departments except in neonate unit.

Regarding the emergence of MDR bacteria, there are several reasons of which the most important is due to genetic changes in the bacteria such as chromosomal mutation or acquisition of a plasmid or transposon. one fact is that bacterial resistance to antibiotics may be by Transformation; bacteria acquire exogenous genetic material that leads to antimicrobial resistance as for example ***pneumococci*** can take up foreign DNA and incorporate it into their chromosome. The others are Transduction and Conjugation. In Transduction the bacterial genes are carried by bacteriophage (bacterial viruses). In Conjugation the bacteria mate with other strains and pass copy of resistance to the mating partner. So one of the important mechanism of developing to MDR Strain is due to the genes that mediate for resistance are found on transferable plasmids or on transposons that can be disseminated among various bacteria by conjugations. The transposons are mobile pieces of DNA (called transposons because they can move from plasmids to chromosomes or vice versa) that can insert themselves into various locations on the bacterial chromosomes as well as move into the plasmid. Some transposons or plasmid have genetic elements termed integrons that enable them to capture exogenous genes. A number of genes may therefore be inserted into a given integron resulting in resistance to multiple antibiotic[15,16] One organism can emerge with many different resistances(a common feature in clinical resistant isolates) All these contribute to the basic problem of MDR Bacterial infections. Because of genetic adoptability, the continued emergence of MDR resistance can not be easily controlled. Although there is now an urgent need of discovering

new class of antimicrobial drugs; and in this concern the pharmaceutical companies also will eventually produce the new drugs. The drug will be more expensive and of course may be more toxic. This resistancy problem can not be solved if rational use of drugs is not followed. Prudent use of antibiotics will not only curtail health care costs and the potential side effects to the individual taking these drugs, but also diminish the wide ecologic effects leading to selection of antibiotic.

Obviously the resistance problem has been aggravated by the misuse and overuse of antibiotics throughout the world in the treatment of man, animals and agriculture. The effect of such usage is a general ecologic selection of those resistant bacteria which survive. Antibiotic resistance is not static. Not only do resistant bacteria travel from place to place and from country to country, but also their resistance genes move among diverse species. The resistant genes are located in plasmid which can be transferred among different types of bacteria. Even resistant strains of animal or human commensals that do not produce human disease themselves may still cause problems, if they transmit their resistance genes to human pathogens. The fact, one has to think, is that even resistant strains of human commensals that do not produce human disease themselves may still cause problems, if they transmit their resistance genes to human pathogens as for example a resistance gene that started out in an animal strain of ***Salmonella typhimurium*** could end up in ***Klebsiella pneumoniae***; similarly a resistance gene in an animal strain of ***Enterococcus faecium*** could end up in ***Staphylococcus aureus*** or other human pathogens. One of the important causes of increases of MDR strains is due to irrational veterinary practices. Many of us know that major group of antibiotics used in veterinary practice are also the drugs for the human. Antibiotics in animal feed are mainly used to accelerate the growth rate by about 15% and to reduce feed intake by 2.5%. ; in this concern there are studies and reports[17,18] that use of antibiotics in animal husbandry contributes to the emergence of resistance to antibiotics. Livestock products like milk and meat are the source of human food. It has also been found that many of the isolate from bovine milk developed mild to higher degree of resistance to most of the commonly used antibiotics in Nepal and also residual antibiotics in these items can have deleterious effect in human health. Hence withdrawal of antibiotic treatment is necessary before slaughtering for meat or using milk during the treatment as the concentration of antibiotics is very high in these products. World Health Organization recommends subtherapeutic use of fluoroquinolones in food animals will lead to rapid emergence as well as the dissemination of resistant gene to humans with adverse health consequences; therefore use of fluoroquinolones in food animals should be discouraged. The antibiotics used for treatment of infection in human should not be used as growth promoters for animals. In one study [19] it was found that 79% of poultry carcasses taken from supermarkets or local meat market contained ***vancomycin*** resistant ***enterococci***. There was also a report [20] that the main problems in human health resulting from the development of antibiotic

resistant bacteria have arisen from the use of antibiotics in human medicines rather than in animals. Therefore the problem cannot solved by accusing to the veterinary doctors the hospital clinicians also must be blamed. Issues to be addressed in human medicine included rational use, drug quality and hospital infection. If drug quality is not assured and rational use of drug is not followed this might contribute to the emergence of resistance to antibiotics. One report[21] showed that only 20% of the drugs are manufactured in Nepal and rests are imported from India and other countries; marketing of drugs are out of government control. The people take advantage of the limited control mechanism; poor and fake drugs are coming in the markets. The drugs are available freely without the prescription of the Medical doctors; every one is free for access to antibiotics. One important favouring factor for antibiotics misuse in Nepal is because of this situation. Because of free access to antibiotic, improper use of antibiotic and increased emergence of MDR strains now is the time to introduce the new regulation on antibiotics such as identification of prescribing authority : health provider or other health workers should allowed to prescribe the drug depending on the certificates they achieved. In present situation the antibiotics are recommended to the patients by health workers in different level of health care; many of the treatment are irrational. Because of misuse and overuse of drugs, once highly effective, are becoming increasing ineffective to kill bacteria. In many parts of the world, inexpensive, safe antibiotic are no longer useful due to the bacterial resistance. Newer drugs are often expensive and unaffordable. Resistance to antibiotic doesn't remain within that particular resistant bacteria, since many of the resistant trails can be transferred from one kind of resistant to other bacteria, even of different types

Duration of treatment is also the factor in appearance of drug resistant bacteria. Use of a single antibiotic for weeks in animals and man, at therapeutic or subtherapeutic levels, lead to colonization in gastrointestinal tract by multiresistant forms of bacteria [21,37]. Following discontinuation of antibiotics, susceptible organisms do eventually return to colonize the ecologic site, although this process may be slow. The most effective and least expensive way to prevent the emergence of resistant strains is to use antibiotics appropriately and for designated periods of time (as short as needed) thereby reducing their overall selective effects. Large amounts of antibiotics are not generally needed; just enough of the correct drug can go a long way in eradicating a disease problem. Resistancy propagates where antibiotics are being overused or misused in the face of resistance already present.

Understanding the genetics of resistance, the practitioners, the other caterories of health provider need to understand the dosage and timing in the treatment of particular infections. Before use of antibiotics one should know which is specified for a particular bacterial infection.

Recommendation:

1. Communicate to all categories of the health providers about the serious problems caused by emergence of MDR Bacterial Strains.

2. Disseminate the patterns of MDR in species of bacteria from the infected area of body.

3. Collect or share the information of Data in species of MDR bacterial strains from all categories of patients in zonal hospitals

4. Facilitate the laboratory from zonal hospital to municipality hospital including teaching hospital to study the epidemiology of MDR bacterial infection.

5. Develop the basic need Quality Control and then in participation of Quality Assurance Programme in AMR testing methodology.

6. Arrange for Infection Prevention Symposium / Workshop including Hand hygiene barrier protection, environmental control to control to transmission of bacterial flora.

7. Establish the methods and standards for evaluating Hospital Acquired Infection.

8. Dessiminate or share of Data of Hospital Acquired Infection of all hospitals.

9. Establish / identify the reference laboratory to support to develop the other laboratories for AMR study.

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